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Explaining public investment in Western Europe

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Abstract

Budgetary consolidations are considered the obvious explanation for the decline in public investment that most Western European countries experienced over the past three decades. However, regressions based on budgetary variables tend to overpredict public investment during the post 1990-period, i.e., when the budgetary stress eased.

We supplement the budgetary consolidation approach to public investment with ideas from behavioural economics to explain why these investments do not increase when additional budgetary resources are available. We use the peak/end evaluation procedure to capture the frustration of voters as cuts in government consumption expenditures accumulate. This 'memory-effect' of budgetary consolidations implies that voters recall the previous peak government consumption expenditures. They remain discontent as long as current expenditures are below the peak value. When the budgetary situation improves, policy makers will choose to increase government consumption because this is electorally more rewarding. Public investment will thus decline when budgetary consolidations are imposed and will remain constant when additional budgetary resources emerge.

We test for a memory-effect by introducing expenditure gaps in public investment regressions. These gaps equal the difference between the highest previously observed primary government consumption to GDP ratio and the current ratio. The regression results for most EU-countries supportou r assumption.

I. **Introduction**

Public investment declined sharply over the past three decades in many Western European countries. Noteworthy exceptions are the Mediterranean countries Greece, Portugal and Spain. Following the pioneering studies of Aschauer (1989a and 1989b) on the productivity of public investment, economists studied quite intensively the consequences of this decline[1]. Only a few studies focus on the explanations for the lower level of public investment. These are most of the time inspired by studies on fiscal consolidations (see Giudice, Turrini and in 't Veld, 2003, p. 7 for a survey of fiscal consolidation studies). The main conclusion of this research is that public investment suffered from the budgetary consolidation processes that many countries had to impose to avoid a further deterioration of their public finances. Econometric studies on public investment thus incorporate variables that capture the financial stress of government budgets.

Public investment has never been a 'popular' policy or research item. The policy neglect of public investment is easily explained from a budgetary point of view: public investment was never and is certainly not today an important budgetary item. The recent academic disregard of public investment accords, however, with earlier experiences. Indeed, skipping through surveys of the literature on the growth of government expenditures[2] one does not find many references to public investment. One obvious explanation is thatpublic investment wa s never an important determinant of the growth of government expenditures.

The literature on the impact of consolidations on public investment looks at how policy makers can limit the electoral damage from budgetary consolidations required by the precarious state of public finances. The large drop in public investment in the seventies and eighties is straightforwardly and adequately explained by the relative insensitivity of voters to cuts in public investment. The improving state of public finances in the nineties did, however, not resulted in a recovery of public investment as one could have expected. Indeed, the ex post forecast performance for the nineties and the first few years of the new millennium of regressions based on the budgetary consolidation view of public investment, is, most of the time, disappointing. This indicates that the consolidation view on public investment is, at least, incomplete. We propose to extend the budgetary consolidation approach to public

[1] See, for example, Baltagi and Pinnoi (1995), Berndt and Hansson (1991), Clark, Elsby and Love (2001), Conrad and Seitz (1994), Evans and Karras (1994), Ford and Poret (1991), Mehrotra and Välilä (2005), Sturm and De Haan (1995 and 1998) and Van Houdt, Mathä and Smid (2000).
[2] See, for example, Gemmell (1993), Lybeck (1986) and Lybeck and Henrekson (1988).

investment by a variable that captures the 'history' of past cuts in government consumption expenditures. The argument is simple: when cuts in public investment instead of in consumption expenditures limit the electoral damage of consolidations, increases in public investments will not be the preferred choice of the incumbent policy makers once the consolidations are over. Instead, they will favour increases in government consumption expenditures because voters are more sensitive to these. The argument thus questions the existence of a memory-effect of budgetary consolidations.

In order to test for a memory-effect, we assume that voters use a simple backward-looking rule for the evaluation of policy makers. More specific, they are believed to compare the current level of primary government consumption expenditures to the highest level experienced previously. This expenditure gap is a measure of past expenditure cuts and is assumed to reflect the discontent of voters with past and current budgetary policies. In order to maximize their electoral support, policy makers will thus seek to reduce the expenditure gap. This evaluation idea which consists of a comparison between the highest level observed previously and the current level originated in psychological studies about how patients remembered painful medical examinations. It is known as the peak/end evaluation procedure. References can be found in texts on behavioural economics (see Kahneman, Wakker and Sarin, 1997 for references). As far as we could detect, the idea has not been used in applied macro-economic research.

The connection between the expenditure gap and public investment extends the assumption that voters are much more sensitive to changes in primary public consumption than to adjustments in public investment. As a result, public investment will not only be cut in periods of budgetary stress but will not increase when additional budgetary means are available. This matches the budgetary experience of most countries over the past three decades since initially cuts in public investment were combined with reductions in current expenditures implying a large expenditure gap in the early nineties. In order to minimize the prevailing discontent of voters, policy makers preferred, whenever the budgetary possibilities were there, to increase primary government consumption expenditures rather than public investment. The hypothesis we test is thus whether the 'memory effect' of budgetary cuts can explain the sluggishness of public investment after 1990.

In section 2 we start with a summary of the evidence on the link between budgetary consolidations and public investment. In a next paragraph we report the econometric evidence on public investment. In order to test the existing approaches we also report the results of a small forecasting exercise for the post 1990-period. The poor forecasting record shows, at

least, that the evolution of public investment can not be explained by referring only to a mechanical link with the budgetary situation. In section 3 we formulate an alternative econometric specification. This approach is tested in section 4 on public investment data for 15 Western European countries.

II. Fiscal consolidations and public investment

Introduction

Public investment declined over the past three decades[3] in most Western European countries; noteworthy exceptions are the Mediterranean countries Greece, Portugal and Spain. Some informative statistics on public investment are reported in table 1. More precisely, we report the maximum value of the public investment to GDP ratio, the average value for the seventies and eighties and for the period 1991-2004. Except for France, the maximum value always exceeds 4 percent. This value was, most of the time, observed in the seventies. The average for the first sub-period, reported in the second column, is frequently substantially lower compared to the maximum value illustrating the decline in public investment duri ng the eighties. The decline continued in the second sub-period, except in Greece, Portugal and Spain, three Mediterranean countries that joined the European Union in the eighties and could benefit from important foreign grants. Note that the drop in the public investment ratio is not related to the privatisation operations that occurred over the past two decades since investments by public enterprises are accounted as private investment in the national accounts[4].

Following the pioneering studies by Aschauer (1989a and 1989b) on the productivity of publicinvestment , various researchers studied the consequences of a smaller stock of public capital on economic growth (see, for example, Sturm, 1998, Sturm, 2001, International Monetary Fund, 2004, Romp and De Haan, 2005 and Kamps, 2004 and 2005). Surprisingly, only a few studies focus on the determinants of the decline in publicinvestment . The existing studies are, most of the time, inspired by studies on fiscal consolidations. The parallelism in most countries during the eighties between declining budget deficits and the smaller share of public investment in GDP is indeed striking. This relationship was first observed by Roubini and Sachs (1989, p. 108-109). These authors argued that during fiscal consolidations 'capital

[3] See, for example, International Monetary Fund (2004), Välilä, Kozluk and Mehrotra (2005) or Perée and Välilä (2005) for a general discussion of the evolution of public investment in different countries.
[4] Välilä, Kozluk and Mehrotra (2005), p. 26.

expenditures are the first to be reduced (often drastically)'. Their explanation was that 'they are the least rigid component of expenditures'. Many studies elaborated on this result (see Giudice, Turrini and in 't Veld, 2003 for a list).

More recent research considered the effects of the Maastricht Treaty and the Stability and Growth Pact on public investment. Gali and Perotti (2003), for example, find that the Pact did not affect public investment. They argue that the decline in this component of government spending started earlier and that the decline in non-emu countries was even larger.

The main conclusion of this research is that public investment suffered from the fiscal consolidations that many, if not all, countries had to impose sometime over the past decades. Econometric research followed this line of argument by incorporating variables that capture the financial stress situation of governments (especially the debt and deficit).

[Here table 1]

Econometric evidence on public investment[5]

All in all, not that many authors have attempted to estimate econometric relationships for publicinvestment . Early studies were initiated by Lybeck and Henrekson (1988). They concern public investment in France (Aubin, Berdot, Goyeau and Lafay, 1988), Sweden (Henrekson, 1988), Germany (Kirchgässner and Pommerehne, 1988) and Norway (Sorensen, 1988). Note that the regressions were not developed to explain specifically public investment but also government consumption, transfers etc. The specifications capture the then prevailing theories about the growth of government expenditures[6]. Although the specifications differ between countries, a general pattern emerges. First of all, variables are introduced to reflect the general economic condition. It concerns real GDPgrowth , the unemployment rate, the inflation rate, relative prices etc. The state of the financial position of the government is captured by the government deficit or the public debt. In addition, specific demand variables such as the degree of urbanization, the labour force participation rate and some demographic indicators are important too. Finally, in all regressions at least one political variable appears.

[5] See De Haan, Sturm and Sikken (1996) for a tabular presentation of the econometric studies that were available in the mid 1990's. See also Lybeck (1986) and Gemmell (1993) for surveys of the theories of the growth of the government.

[6] See Lybeck (1988), chapter 3 for explanations about how the studies relate to the theories explaining the growth of governments.

They relate to elections, the ideology of the government or the type of government (majority, coalition etc.).

The results are rather conflicting as is illustrated by two citations. Henrekson (1988, p. 123) notes that 'the theories expounded in the government growth literature are not wholly suited to explaining government investment alone'. Aubin, Berdot, Goyeau and Lafay (1988, p. 223) observe that 'compared with other types of expenditure, public investment is less demand-determined'.

Van Dalen and Swank (1996) report evidence that spending on infrastructure in the Netherlands was higher under right-wing governments than under left-wing governments. De Haan, Sturm and Sikken (1996)[7] use a panel data set of OECD countries. The dependent variable is either the share of government investment in GDP or in total government expenditures. The most interesting results show that public investment can be explained by the lagged dependent variable, the differential between changes in the price index of government expenditures and GDP, a fiscal stringency variable (equal to one when the structural deficit is reduced by at least 1 percent of GDP) and by private investment (these are complementary with public investments). Do note that several political variables were tested but did not produced significant coefficients.

Sturm and De Haan (1998)[8] apply the Granger causality test to Dutch public investments. For our use it suffices to report that they do not find any causality running from the deficit, the debt or interest payments to public investment; population growth, however, causes public investment. One should take into account that the sample ends in 1984, i.e., before the start of some important fiscal consolidations.

Sturm (2001) tests three hypotheses about public investment on a panel of 123 non-OECD countries. A first one explains public investment by structural variables, i.e., by the degree of urbanization and population growth (Wagner's law). A second hypothesis is captured by economic-financial variables. It concerns variables such as economic growth, the budget deficit, government debt, interest payment on this debt, private and foreign aid, the degree of openness and foreign direct investment. A last hypothesis implies politico-institutional variables. These reflect the ideology of the executive, electoral cycles, the presence of coalition governments, the degree of economic and political freedom and the degree of political instability. Of interest to us is that the relationship between public investment and public deficits is time-dependent: higher current deficits stimulate investments but larger past

[7] See also Sturm (1998), chapter 3.
[8] See also or Sturm (1998), chapter 2.

deficits decrease them. This result also holds for public debt. Finally, politico-institutional variables were not associated with significant coefficients.

Turrini (2004) derives his regression from a two stage optimization process. In a first stage the optimal value for the cyclically adjusted deficit is determined so as to minimize a quadratic loss function in the output gap, the deviation of debt from a target level and the change in the cyclically adjusted primary deficit. In the second stage, public investment is determined so as to minimize the difference with an 'efficiency-maximising investment level' and the deviation of total government expenditures from a target level. One interesting feature of this approach is the attention paid to the budgetary inertia: important changes in the deficit and primary expenditures are penalized.

The estimation results for a panel data set of 14 EU-countries for the period 1970-2002 indicate that public investment is especially sensitive to lagged real output per head, much less to the output gap. The coefficients of the debt and the cyclically adjusted primary deficit are significantly negative, sustaining the expectation that the decline in public investment is related to a worsening of the budgetary situation. Restricting the sample to the post-1993 period for EMU-countries increases the effect of the debt level. This result is confirmed by the regression results of a model that contains post-1993 dummies. Turrini concludes that efficiency and not stabilisation motives characterise public investment. Furthermore, budgetary consolidations have influenced public investment indirectly through the behaviour of fiscal authorities. More specifically, the weights attached to the goals in the loss functions were affected by the EMU-consolidations.

Perée and Välilä (2005) explain public investment by traditional (lagged) variables such as real GDP, interest rates, the deficit and the debt level and by an EMU-dummy (equal to one starting in 1993). In addition, the deficit is disaggregated into revenues and expenditures. The model is estimated for a panel of 10 EU-members; a re-estimation for four cohesion countries serves as a test. The results are satisfactory: all variables except the EMU-dummy differ significantly from zero. The positive coefficient of real GDP indicates that public investment can be considered a 'luxury commodity'. Whereas the debt and deficit levels have the expected negative sign, the positive sign of the interest rate is difficult to explain when it serves as a proxy for interest charges.

Perée and Välilä (2005) expand their model with the lagged dependent variable and a time trend. This regression is estimated for ten EU-member countries[9]. Striking is that, looking at

[9] In Perée and Välilä (2005) only the regression results with significant coefficients are given; Mehrotra and Välilä (2005) report the complete results.

the results as a whole, the negative time trend appears to be the single most important variable: the trend is present in all equations and differs significantly from zero in 8 out of 10 regressions; the debt level is significant in 5 regressions. In Mehrotra and Välilä (2005) the previous results are further sustained by a cointegration analysis. All in all, the estimated regressions in both studies catch rather well the downward trend in the series. However, only one variable, the debt level, provides an economic explanation for this evolution.

In summary, most if not all existing studies explain the decline in public investment by traditional indicators of the stance of public finances, i.e., the public deficit and the public debt. A few authors do add dummy variables to capture situations of financial crises (for example, De Haan, Sturm and Sikken, 1996) or to impose regime shifts in the regressions (Turrini, 2004). Note also that several authors introduce political variables but the results are mixed.

The forecasting record of the relationship between public investment and public finance variables

The conclusion about a direct relationship between the decline in public investment and the budgetary consolidations seems, theoretically and econometrically, quite convincing and robust However, a closer look does reveal some important problems.

A first problem is that the sample period of most studies, beginning somewhere in the seventies and ending in the mid-nineties or around 2000, is not really homogenous as to the stance of public finances. Although many European countries struggled to meet the public finance criteria of the Maastricht Treaty in the nineties, the threat of financial crises due to unsustainable budgetary policies was much bigger in the eighties. So the financial constraint on budgetary policies was relatively looser in the nineties compared to the eighties. This was, partly, the result of the reduction in interest payments and the widespread increase in taxes.

If the evolution of the deficit is used as a rough guide for the link between public investment and fiscal consolidations, one would expect some recovery of public investment in the nineties from the trough in the eighties. The deficit indeed improved spectacularly in all European countries and appears, in one form or another, in most regressions explaining public investment. However, in general, public investment did not show any rebound at all, on the contrary.

The experience of the nineties must thus shed some doubt on the simple relationship between the budgetary situation, expressed by variables as the government debt and the

deficit, and the evolution of public investment. We explore this further in table 2. We first estimate simple regressions that explain public investment over the pre-1990 period; all data are expressed as a percentage of GDP. The explanatory variables are reported in the second column and are compatible with the existing studies on the relationship between public investment and budgetary consolidations. Notice that due to missing data, we could not estimate regressions for Finland, Portugal and Spain, and that probably better specifications could have been found if a thorough econometric analysis would have been made. Notwithstanding this, most of the regressions are quite satisfactory with coefficients of determination exceeding 0.9. The explanatory variables tested and eventually retained were: the total and the primary deficit, the total and primary cyclically corrected deficit, interest payments and the government debt.

The third and fourth column report on the forecasting performance of the estimated regressions. It concerns a dynamic forecasting exercise whereby the lagged endogenous variable is the past forecast. Two summary indicators of the quality of the forecasts are reported: the root mean square error and the forecast error for the last year of the sample period, i.e., 2004. The striking feature of the forecasts is that most 2004-errors are negative indicating a general over-prediction. The size of the errors is frequently quite important, amounting sometimes to one half of the 1991-2004 average of public investment. Also note that no direct relationship appears to exist between the quality of the regression and its forecasting performance.

The preceding short forecasting analysis at least indicates that the traditional specification of public investment regressions is deficient. Indeed, the improvements in the budgetary finances in the nineties leads to the forecast that public investment would recover somewhat but the data do not support this view. On the contrary, the downward trend of the eighties continued, in most countries, during the nineties.

The conclusion to be drawn from this forecasting exercise is not to discard the budgetary approach that proved to be appropriate to explain the decline in public investment in the seventies and eighties. However, we would stress that this theory should be supplemented by an approach that explains why public investment did not recover in the nineties. One obvious explanation, the European Monetary integration phenomenon (the Maastricht Treaty and the Stability and Growth Pact) can already be rejected since in the regressions we report later, dummy variables that capture these events do not appear systematically. One should thus look for another explanation.

[Here Table 2]

III. Explaining public investment

Public investment and budgetary variables: is there symmetry?

Although the forecasting record of the regressions that explain public investment by budgetary variables is rather poor, this does not necessarily imply a rejection of the underlying theory, i.e., the link between public investment and the financial situation of the government. Eventually, the econometric translation of the theory could be inaccurate and/or incomplete.

We acknowledge the explanations advanced for the link between public investment and budgetary consolidations. Besides the technical budgetary argument mentioned before, i.e., the ease to reduce public investment, authors refer to electoral arguments: public investment is a less visible type of expenditure so, less political resistance exists when they are cut back (see, for example, Roubini and Sachs, 1989; Oxley and Martin, 1991; De Haan, Sturm and Sikken, 1996 and Sturm 1998). In a nutshell: cutting public investment is perceived as less electorally punitive compared to reducing government consumption expenditures The minimization of electoral damage is thus seen as, at least, a constraint on budgetary consolidation programs. Note that this assumes that voters are short-sighted. Indeed, when voters are assumed to prefer cuts in public investment to reductions in consumption expenditures, they neglect the long run effects of cuts in public investment, i.e., the impact on the structural growth potential of the economy. Furthermore, voters are also assumed to ignore that by limiting cuts in government consumption expenditures, budgetary consolidations will tend to be less successful[10]. As a result, it becomes more probable that in the future new budgetary consolidations will have to be imposed.

Accepting that the composition of budgetary consolidations is influenced by electoral concerns is not without further consequences. Indeed, electoral aspects will then also affect the allocation of budgetary resources when the financial position of the government improves. In the regression specifications, improvements in budgetary variables will, neglecting the sign, have a similar impact as deteriorations. A careful interpretation of the 'election'-approach to the composition of budgetary consolidations does, however, not lead to the prediction of a recovery of public investment when budgetary resources improve. Indeed, if it

[10] See summary table in Giudice, Turrini and in 't Veld (2003), p. 7.

is electorally less punitive to cut public investment when budgetary consolidations need to be imposed, one expects, ceteris paribus, that it will be less rewarding to increase these expenditures when budgetary variables improve. Phrased differently, when consumption expenditures are spared in budgetary stress situations, they will also be favoured afterwards.

The election approach thus holds that public investment will decline when budgetary consolidations are imposed and remain relatively stable when government finances improve. The effect of budgetary variables on public investment is thus not symmetric. At least additional variables that capture more directly the electoral consequences of budgetary choices should be considered.

The election motive of policy makers is thus not only able to explain the decline in public investment in the seventies and eighties but also the continuous slack in public investment in the nineties. The important empirical implication is that the bad forecast record is not due to an inappropriate theory, but to an unfortunate empirical formulation of that theory. The formulation indeed assumes that the budgetary variables do capture the sentiment of voters. This is acceptable whenever these variables deteriorate, not when they improve.

Do past cuts in government consumption matter?

The conclusion that the traditional specifications of the public investment regressions are inappropriate because of the symmetry they imply with respect to the effects of budgetary variables does not lead straightforwardly to a more appropriate specification. However, a second aspect of these traditional regressions is more helpful. This feature relates to the implicitly assumed rationality of voters. If voters are perfectly informed and rational, they will not be misled by deficit spending and therefore by the timing of taxation. Voters will then be forward looking and thus only be interested in knowing whether government finances are on a sustainable path, i.e., whether current and future taxes match current and future expenditures and the outstanding stock of debt. Reductions in government expenditures compensated by smaller deficits will thus not, in general, affect voters since they know that there is an offsetting effect operating through total taxes. Rationality thus implies that the 'road' to sustainable government finances, the 'content' of the budgetary consolidation, is completely irrelevant. Furthermore, voters will have no specific preference for cuts in public investment or in government consumption expenditures since they will consider the longer run benefits of investments by the government.

The evidence discussed previously, however, indicates that policy makers do modulate the composition of the budgetary consolidations so as to limit the electoral damage. The mainstream explanation for the decline in public investment holds that voters are less sensitive to cuts in public investment compared to cuts in government consumption expenditures. Obviously, this not only reflects the hypothesis that voters are myopic since they overlook the longer run benefits of public investment but also that government consumption expenditures are the yardstick used by voters to evaluate the performance of the incumbent policy makers

Notwithstanding the preference of policy makers for cuts in public investment over those in consumption expenditures, one must concede that in reality consumption expenditures had to bear the brunt of the budgetary consolidations. Indeed, in the early eighties public investment amounted, on average, to less than one tenth of total government expenditures. Any important budgetary consolidation operation required therefore large reductions in government consumption expenditures. The resulting electoral damage for the incumbent policy makers is evident.

However, once elections have been called, it is, implicitly, assumed that the dissatisfaction of voters disappears completely. In no way do reductions in government consumption expenditures that were imposed before these elections affect the policies devised by the new incumbent policy makers: these policy makers are assumed to start with a blank sheet. This contradicts the assumption that the level of government consumption expenditures is important to voters. In order to remedy this incoherence, we need to stipulate that, at any time, the evaluation of incumbent policy makers not only depends on the current level of these expenditures but also on all previous cuts in these expenditures. New incumbents will thus be evaluated negatively as long as all previous cuts in government consumption expenditures are not reversed. The resulting electoral pressure will then force these policy makers to offset, if budgetary resources are available, previous expenditure reductions[11]. The impact of previous cuts in government consumption expenditures is defined as the 'memory-effect'.

The preceding discussion implies that the rationality of voters is a necessary assumption for consolidation processes to be successful since rational voters will look forward and thus evaluate budgetary consolidations as to their effect on the sustainability of public finances. Cuts in government consumption will then not receive any special attention. If, however,

[11] One can link this view to the behavioural finance result that holds that investors will keep their stocks until previous losses are offset. This effect is known as the disposition-effect; investor are then said to suffer from 'get-evenitis' (see Shrefrin, 2000, chapter 9).

voters care about the level of government consumption, incumbent policy makers will be under electoral pressure to reverse previous cuts in government consumption expenditures. Admittedly, this amounts to a replication of preceding budgetary errors but since politics is about being and staying an incumbent policy maker, popularity scores do matter. Successful consolidations are not only devised by policy makers who can resist the pressure to reverse expenditure cuts to increase their popularity but require also the ensuing generations of policy makers to possess this quality. Incumbent policy makers who are unable to defy the temptation to increase their popularity by raising consumption expenditures will have managed an unsuccessful consolidation process or will have disrupted an up to then successful consolidation.

The introduction of a 'memory-effect' linked to past levels of government consumption expenditures has important implications for the specification of regressions covering budgetary as well as post post-budgetary consolidation periods. The traditional specification of public investment regressions reflects only the view prevalent in budgetary consolidation periods that voters sanction incumbent policy makers because they assimilate cuts in consumption government expenditures with incompetence and thus vote for rivals in the subsequent elections. At the end of budgetary consolidations, the discontent of voters is assumed to disappear so any improvement in the budgetary situation leads one to expect that public investment will increase. As illustrated, this specification is not able to explain the stagnation of public investment in the post-consolidation period. Our solution to this problem is to abandon the assumption of rational voters and to introduce previous cuts in government consumption expenditures so as to capture the latent discontent of voters.

Summarizing, our assumption about the behaviour of voters extends the traditional view expressed in public investment regressions that incumbent policy makers care for their re-election and thus will, during a consolidation process, aim to minimize the discontent of voters by reducing relatively more public investment. When the budgetary stress alleviates, voters will confront policy makers with the accumulated expenditure cuts and aim for a reversal of these cuts. As a result, public investment will be penalized not only during a budgetary consolidation operation but also afterwards. Taken at face value, this approach predicts that the outlook for public investment will remain bleak as long as the level of government consumption expenditures has not been restored to the pre-consolidation level.

Note that the exposed link between past and current budgetary policies does exist in the theory of the growth of the government. For example, 'the displacement effect' developed by Peacock and Wiseman (1967), holds that people accept higher taxes imposed during war

times to finance military expenditures. Once the war is over, military expenditures are replaced by other expenditures since the public is used to the higher taxes and expenditures. This theory thus implies an acceptance of high levels of taxation and expenditures because they become reference or anchor values. The rise in taxes as a result of the growth in welfare expenditures induced by the crisis of the mid-seventies can be interpreted similarly as the war experience. Do note that the similarities are limited since the post-war switch from military to other expenditures differs from what occurred in the second half of the seventies.

Measuring voters' dissatisfaction

Whether discontent voters exert pressure to revert the consolidation process can be tested if the dissatisfaction of voters can be adequately formulated and quantified. We propose a simple indicator of the dissatisfaction of voters that is based on two elements of behavioural economics. First, we suppose that voters evaluate current incumbent policy makers using government consumption expenditures and separate these expenditures from their other financial operations. This can be rationalized by referring to a mental accounting process: consumption expenditures capture directly visible expenditures such as compensation of employees and transfers that differ from other income sources. Second, voters use a simple evaluation technique, more precisely, the peak/end evaluation procedure. This is the most vital assumption we make. We base this procedure on studies of how individuals evaluate pain. Several experiments (see, for example, Kahneman, Wakker and Sarin, 1997 and Kahneman, 2003 for references) indicate that people evaluate pain by referring to the highest disutility and the one recorded at the end of the experience. All other information, including the duration of the experiment, is neglected. For obvious reasons this effect is also known as the 'memory bias'. This peak/end reference framework can be easily transposed to budgetary consolidations and interpreted as a measure of the discontent of voters. This discontent measure can be evaluated in a regression explaining public investment. Note that any test will be a combined test of the quantification of the attitude of voters and the particular hypothesis that stipulates an effect for this attitude. A negative outcome could thus indicate that the variable capturing the attitude of voters was inappropriate and/or that the assumption about its impact is wrong.

The anchor, 'the peak', is defined as the maximum ratio of primary government consumption expenditures to GDP observed previously[12]. We stress thatpublic investment are excluded[13]. Since we consider primary expenditures, interest payments are also excluded. These payments to debt holders are indeed quite different from, for example, transfers. We thus define the expenditure gap as the difference between the anchor and the current primary government consumption expenditure ratio.

The memory-effect of budgetary consolidations holds that positive expenditure gaps results from cuts in primary government consumption expenditures and measure the discontent of voters associated with these budgetary cuts. Incumbent policy makers will then strive to lower this discontent by reversing the cuts in government consumption expenditures. When budgetary resources are limited, the reversing process can take a long time. One can not exclude that the memory-effect also operates when government consumption expenditures rise. In that case, the effect will dampen the increase in expenditures. It is also an empirical matter whether voters consider the evolution of taxes. For this reason we distinguish between the gross and the net expenditure gap.

The gross expenditure gap is defined as:

$$GGgap_t = Gmax_t - G_t \qquad \text{where Gmax is max } \{G_{t-1}, \ldots\} \qquad [1]$$

where GGgap is the gross expenditure gap as a percentage of GDP, Gmax is the maximal value for primary government consumption expenditures as a percentage of GDP observed previously and G are the observed primary government consumption expenditures as a percentage of GDP. In order to test for non-linearities we replaced the negative values in the expenditure gap variable by zeros; this is the $GGgapZ_t$ variable. Note that both expenditure gaps express the assumption that the highest observed values are the central reference values that guide voters[14].

Budgetary consolidations will increase the expenditure gaps whenever primary consumption government expenditures are reduced to either lower the deficit, finance lower taxes or pay for rising interest payments on the government debt. In general, the expenditure gaps will rise as the budgetary consolidations proceed. The regressions will test what effect, if

[12] Note that anchoring is also an element of behavioural decision making.

[13] For expository reasons we will not systematically repeat that the primary consumption expenditures considered exclude public investment. This budgetary item is eliminated so as to avoid spurious correlation when the expenditure gaps are introduced as explanatory variables in public investment regressions.

[14] This is an approximation to the well known utility function in behavioural finance that expresses prospect theory whereby the part that reflects the utility associated with gains is replaced by the abscissa.

any, this exert on the evolution of public investment and thus, indirectly, on the consolidation process. Furthermore, at the end of the consolidation process, the expenditure gap will, most likely, be positive and so we are able to test whether the dissatisfaction of voters, approximated by this gap, still affects public investment. The assumption being tested is that voters will be discontent as long as government consumption expenditures have not recovered to their previous maximal value. Meanwhile public investment will be affected negatively.

The gross expenditure gap excludes taxes so cuts in expenditures that are matched by cuts in taxes increase the gross expenditure gap. The net expenditure gap incorporates the change in total taxes over the period that covers the expenditure gap. More precisely:

$$NGgap_t = GGgap_t - [T_{Gmax} - T_t] \quad [2]$$

where NGgap is the net government expenditure gap, and T_{Gmax} is the tax to GDP ratio in the year of Gmax and T is the tax ratio. In $NGgapZ_t$, the net government expenditure gap, negative values of $NGgap_t$ are replaced by zero. Note that the net expenditure gap exceeds the gross expenditures gap whenever taxes increased compared to the year the maximal value of expenditures was observed.

Whether the gross or the net expenditure gap is the most appropriate variable to capture the dissatisfaction of voters depends on their tax awareness. If voters suffer from an important degree of fiscal illusion, they will only consider changes in primary government consumption expenditures. So the regressions also offer some evidence on the existence of that illusion.

Table 3 reports some general information on the gross and net expenditure gaps. The gross gaps, with the exception of Greece and Portugal, still show a positive value in 2004, the final year of the sample period. This implies that the level of primary consumption expenditures is still below the maximum level observed over the previous three decades. Especially the maximum value for the gross expenditure gap reveals the expenditure cuts that have been imposed during budgetary consolidations. Values above 10 percent are observed for Finland, Ireland, Netherlands, Norway and Sweden. The difference between the maximum value and the value observed in 2004 indicates to what extent policy makers were successful to resist the pressure to compensate for the past expenditure cuts. Austria, Finland, Ireland, Netherlands, Norway, Spain and Sweden belong to the group of successful countries, i.e., to the group of countries where the 2004-value for the expenditure gaps is comparable to the maximum value.

[Here Table 3]

The net expenditure gap includes the change in the tax ratio. A higher tax ratio increases the discontent of voters. Most of the time budgetary consolidations incorporate tax increases as well as expenditure cuts but this does not systematically imply that the net expenditure gap exceeds the gross gap because of timing differences. This is the case for Germany and Norway. In only three countries, Ireland, the Netherlands and the United Kingdom, were taxes reduced and expenditures cut simultaneously, alleviating the discontent of voters. Finally, we note that the gross as well as the net expenditure gap indicates that, if our interpretation is correct, the discontent by voters is, in general, still important at the end of the sample period. Indeed, the net expenditure gap exceeds 5 percent of GDP in 10 out of the 15 countries of our sample. The exceptions are: Austria, France, Germany, the Netherlands and the United Kingdom.

IV. Regression results

The specification of the public investment regressions resembles, partly, other research on public investment. Indeed, one can not discard that in most countries the downward slide of public investment started when developments in public finances appeared to be unsustainable. We capture this process by including budgetary indicators that also appear in previous studies on public investment. It concerns variables such as interest payments, the total deficit, the primary deficit and the debt. These variables function as the catalyst of the consolidation process. A second group of variables, the cyclically adjusted total and primary deficit, reflects the stabilization goal that the governments, eventually, could pursue.

Our innovation consists in introducing the expenditure gap variables. These are supposed to reflect the discontent of voters with the previously experienced budgetary consolidations and so to exert pressure on the incumbent policy makers to offset the cuts in primary government consumption expenditures. As a result, public investment will not rise once additional budgetary resources turn out to be available at the end of consolidations. We expect the expenditure gaps to have a negative sign since the offsetting of previous cuts in primary government consumption depresses public investment.

The sample consists of 14 member countries of the European Union (not Luxembourg and the new member-countries) plus Norway. The sample starts most of the time in 1972 and ends in 2004. Table 4 reports the results.

The statistical quality of the results for most countries is very satisfactory. For two countries no acceptable results were obtained. We could have deleted these cases but feel that negative results also contain useful information. Note that it concerns Greece and Spain, two countries that joined the European Union only in the eighties (Greece in 1981 and Spain in 1986). Since both countries received important European grants, this could 'disturb' the estimation results. Indeed, the data in table 1 illustrate that, on average, public investment increased only considerably in Greece and Spain after 1990. Note that the regression for Portugal, a country that joined the European Union together with Spain and also benefited from money flows from the regional funds, is, although acceptable, the poorest of the group. Finally, we recall that the regression for Greece in table 2 was already quite poor.

[Here Table 4]

Supporting evidence for our assumption about the impact of the expenditure gaps on public investment is that the regressions perform quite well for those countries that experienced a sharp drop in public expenditures and are less convincing for countries where public investment declined only moderately. The only exception is the United Kingdom where the drop in public investment is quite pronounced but the regression result is relatively average.

The expenditure gaps explain quite well the evolution of public investment in most countries. The size of the coefficients could appear to be small (about 0.03 when the lagged dependent variable is present) but note that the expenditure gap amounts to, eventualy 5 or 10 percent, so a short run impact of 0.15 or 0.30 percent of GDP is not uncommon. Since the coefficient of the lagged dependent variable equals about 0.5, the longer run effects are about twice as high as the short run ones. Compared to the decline in public investment as reported in table 1, we conclude that the results indicate that the expenditure gaps are able to explain a large fraction, one third to one half, of the decline in public investment. Recall that the results sustain the assumption that the negative impact of previous cuts in primary government consumption on public investment will last as long the expenditure gap is positive, i.e., as long as accumulated reductions in government consumption has not been reversed.

The expenditures gaps that appear in most regressions are those defined in expressions [1] and [2], i.e., the series contain negative as well as positive values. This indicates that when the public consumption ratio tends to rise beyond its previous maximum value, more budgetary resources will also be allocated to public investment. We recall that this indicates that voters use the maximum observed government consumption expenditure ratio as a reference point: additional government expenditures are not appreciated as much as is the case when the expenditure gaps are negative. As a result, policy makers also increase public investment. Concerning the relevancy of the gross and net expenditure gap, we note that the net expenditure gap is present in only three regressions, the one for Denmark, France and Portugal. Two of these regressions, for France and Portugal, are not particularly good but we do not know the relevance of this. Formulated differently, in most countries the gross expenditure gap seems to be an acceptable indicator of the dissatisfaction of voters; voters neglect changes, in general, changes in taxation.

The traditional explanatory variables in regressions that explain public investment are also present in the regressions presented in table 4. It concerns variables that capture the situation of public finances such as the deficit, the debt and interest payments. The sign of the debt and interest payments is unambiguously negative. This is not so for the primary deficit. Indeed, a higher deficit, defined as taxes less expenditures, could lead to lower public investment because the deficit signals budgetary stress; on the other hand, a higher deficit also indicates a weaker economy so the stabilization goal of the government points towards more public investment. The results do indicate that in Austria and Belgium the second interpretation holds; however, the size of the coefficient is quite small. In Denmark the financial interpretation is supported by the data.

The lagged dependent variable is frequently an explanatory variable. This indicates some sluggishness in public investment. Note that we also tested for a negative effect of the Maastricht Treaty and the Stability and Growth Pact. The Maastricht Treaty stipulated the monetary union entry conditions. They required a deficit of less than 3 percent of GDP and a debt ratio of less than 60 percent of GDP in 1997. The main policy implication was that most countries aiming for accession had to reduce their deficit. Maybe surprising, the Maastricht dummy proved only to have an impact on public investment in two countries that did not join the monetary union, i.e., Denmark and the United Kingdom. This not only indicates that the Maastricht-criteria were probably redundant: budgetary consolidations were necessary even without the prospect of joining the monetary union. The criteria that the Stability and Growth Pact contain for public finances only affected public investment in Austria.

V. Conclusions

Public investment is frequently viewed as an important determinant of the structural rate of growth of an economy. In most countries public investment declined significantly over the past decades, certainly if we compare actual levels to the maximum values observed in the seventies or early eighties. This was a period of high but unsustainable public deficits. The subsequent budgetary consolidations reduced all government spending but, proportionally, public investment was especially hard hit: the current public investment to GDP ratio is in many countries less than one half of the maximum observed ratio. However, in some countries such as Finland and France the public investment ratio remained more or less stable. In a few countries, Greece, Ireland and Spain, we even observe an increase.

The usual explanation for the decline in public spending refers to the budgetary consolidations. This is especially convincing to explain the evolution of public investment in the eighties. This approach is, however, not really able to explain why public investment did not recover somewhat during the nineties when the budgetary stress was, in general, lower compared to the eighties. We sustain this view by a small forecasting exercise.

We do not challenge the budgetary consolidation view but supplement it with a memory-effect related to government consumption expenditures. Rational voters do not look back and do not react to cuts in consumption spending of the government during a consolidation process. We argue that voters evaluate incumbent policy makers by comparing the current primary government consumption expenditure ratio to the highest value observed in the past. This peak/end evaluation procedure, a behavioural economics idea, allows a simple quantification of the accumulated discontent of voters related to continuous budgetary consolidations. The tested assumption is that voters pressure incumbent policy makers to reduce this expenditure gap.

Regressions for the main member countries of the European Union support this view. The results do indicate that in most countries, even when budgetary policy is on a sustainable course, public investment will not recover since it is electorally more rewarding for policy makers to increase government consumption expenditures rather than public investment. This view thus introduces a link between past budgetary consolidations and current policies.

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Table 1: Summary statistics of public investments, 1972-2004, in percent of GDP.

	Maximum value (year)	Average: 1972-1990	Average: 1991-2004
Austria	5.44 (1972)	4.1	2.1
Belgium	4.58 (1981)	3.6	1.7
Denmark	4.05 (1972)	2.8	1.8
Finland	3.97 (1975)	3.6	3.0
France	3.75 (1975)	3.2	3.2
Germany	4.40 (1974)	3.3	2.0
Greece	4.21 (2004)	2.8	3.2
Ireland	4.64 (1974)	3.5	2.9
Italy	3.57 (1981)	3.2	2.5
Netherlands	4.41 (1972)	3.4	3.0
Norway	7.89 (1978)	4.0	3.2
Portugal	4.84 (1981)	3.6*	3.7
Spain	5.13 (1990)	3.0	3.7
Sweden	7.06 (1972)	4.8	3.4
UK	5.25 (1974)	3.0	1.8

Notes * : starting 1977.
Source: OECD

Table 2: Forecasting exercise: regressions up 1990 and forecasts statistics 1991-2004.

	Regression up to 1990		Forecasts 1991-2004	
	Explanatory variables (1)	Coeff. of determin.	RMSE (2)	Error 2004
Austria	D, PI(-1)	0.95	0.79	-1.37
Belgium	Pridef, PI(-1)	0.96	0.61	-1.41
Denmark	IP, PI(-1)	0.92	0.63	-0.90
Finland	n.a.	n.a.	n.a.	n.a.
France	D, PI(-1)	0.61	0.34	-0.51
Germany	D, Pridef	0.96	0.39	0.30
Greece	Pridef, PI(-1)	0.44	1.41	1.71
Ireland	IP, PI(-1)	0.79	0.57	-1.46
Italy	Defco, PI(-1)	0.66	0.19	0.28
Netherlands	D, PI(-1)	0.89	0.20	-0.36
Norway	Pridef, PI(-1)	0.80	0.68	-0.09
Portugal	n.a.	n.a.	n.a.	n.a.
Spain	n.a.	n.a.	n.a.	n.a.
Sweden	D, Pridef, PI(-1)	0.97	0.35	-0.54
UK	Pridefco, PI(-1)	0.91	1.60	-1.59

Notes n.a.: indicates that too many observations where missing so that the pre-1990 regression could not be estimated.
(1): D: debt, Defco: total deficit cyclically corrected, IP: interest payments, PI(-1): lagged public investment, Pridef: primary deficit, Pridefco: primary deficit cyclically corrected.
(2): Root mean square error.
Source: OECD.
All data expressed as a percentage of GDP.

Table 3: Summary information on the gross and net expenditure gaps, in percentage of GDP, 1972-2004.

	Gross expenditure gap		Net expenditure gap	
	Maximum value	Value in 2004	Maximum value	Value in 2004
Austria	3.25 (2004)	3.25	5.08 (2002)	4.62
Belgium	9.99 (1990)	6.76	10.91 (2000)	9.87
Denmark	9.73 (1986)	2.93	14.83 (1987)	8.97
Finland	15.93 (2000)	13.59	25.43 (2001)	20.47
France	2.98 (1984)	0.40	5.86 (2000)	2.45
Germany	5.41 (1989)	1.48	5.33 (2000)	0.44
Greece	4.15 (1994)	-4.04	16.85 (2001)	7.91
Ireland	19.99 (2000)	17.24	12.41 (2000)	6.87
Italy	4.03 (2000)	0.92	13.63 (2000)	9.44
Netherlands	13.07 (2000)	9.08	7.28 (2000)	1.56
Norway	18.82 (2001)	14.34	13.27 (2000)	8.34
Portugal	2.23 (1988)	-0.70	12.76 (2004)	12.76
Spain	7.10 (2001)	5.99	12.72 (2003)	11.65
Sweden	16.43 (2001)	15.25	18.28 (2001)	13.30
UK	9.39 (2000)	2.94	4.40 (2000)	-2.80

Notes: The sample period is equal to the period mentioned in table 1; the gross and net expenditure gaps are defined in expression [1] and [2].

Table 4: Regression results, 1972-2004.

		R^2	RC^2	d/h
Austria	$PI_t = 5.17 - 0.14\ GGgap_t - 0.11Pridefco_t - 0.74IP_t - 1.35DGS$ (39.51) (-3.19) (-2.20) (-12.65) (-8.60)	0.96	0.96	1.70
Belgium	$PI_t = 3.61 - 0.14GGgap_{t-1} - 0.14Pridefco_t$ (51.58) (-7.19) (-6.37)	0.95	0.95	1.59
Denmark	$PI_t = 1.39 - 0.03NGgap_{t-1} + 0.03Pridef - 0.10IP_t - 0.21DMa + 0.57PI_{t-1}$ (3.36) (-1.98) (2.39) (-3.10) (-1.92) (4.75)	0.95	0.94	-0.69
Finland	$PI_t = 3.76 - 0.02GGgapZ_t - 0.01D_t$ (62.87) (-4.28) (-5.81)	0.86	0.85	1.98
France	$PI_t = 1.66 - 0.03NGgap_t + 0.50PI_{t-1}$ (3.04) (-1.97) (2.94)	0.68	0.64	1.71*
Germany	$PI_t = 3.09 - 0.04GGgap_t - 0.03D_t + 0.40PI_{t-1}$ (5.74) (-2.70) (-5.88) (3.84)	0.98	0.98	1.24
Greece	No results			
Ireland	$PI_t = 2.33 - 0.03GGgap_t - 0.01D_t + 0.71PI_{t-1}$ (3.95) (-2.62) (-4.26) (8.08)	0.92	0.91	2.27
Italy	$PI_t = 1.71 - 0.09GGgap_t + 0.04(T_{Gmax} - T_t) + 0.48PI_{t-1}$ (3.92) (-2.19) (2.63) (3.58)	0.82	0.80	0.50
Netherlands	$PI_t = 4.15 - 0.03GGgapZ_t - 0.25IP_t$ (33.49) (-4.77) (-8.37)	0.79	0.77	1.47
Norway	$PI_t = 0.91 - 0.03GGgap_t + 0.75PI_{t-1}$ (2.41) (-2.19) (7.63)	0.80	0.78	1.90
Portugal	$PI_t = 2.86 - 0.04NGgap_{t-1} - 0.08IP_t + 0.39PI_{t-1}$ (9.22) (-2.37) (-2.78) (5.06)	0.58	0.53	1.44
Spain	No results			
Sweden	$PI_t = 1.12 - 0.02GGgap_t - 0.09IP_t + 0.73PI_{t-1}$ (4.67) (-2.17) (-2.07) (14.06)	0.96	0.95	0.94
UK	$PI_t = 5.15 - 0.19GGgap_t - 0.61IP_t - 1.01DMa$ (8.35) (-4.44) (-2.99) (-3.41)	0.69	0.66	0.62

The sample period starts in 1972 except for Finland (1976), Ireland (1978), the Netherlands (1980), Norway (1975), Portugal (1977) and Spain (1979).

Notes: where D: debt ratio, Def: total deficit, DMa: Maastricht dummy variable, equal to 1 starting in 1993, DGS: Growth and Stability Pact dummy, equal to 1 starting in 1998, IP: interest payments to GDP ratio, PI: ratio of public investment to GDP, Pridefco: primary deficit cyclically corrected as a ratio of GDP, $(T_{Gmax} - T_t)$: tax ratio in year of maximum primary consumption expenditures, excluding public investment less current tax ratio.

R^2: coefficient of determination, RC^2: this coefficient corrected for degrees of freedom, d/h: the Durbin-Watson or Durbin h autocorrelation statistics. * indicates that an adjustment for autocorrelation has been performed.